MATH 2270

Division: Natural Science and Mathematics
Department: Mathematics
Course: MATH 2270
Title: Linear Algebra
Catalog Description:

Linear algebra is a study of systems of linear equations, matrices, vectors and vector spaces, linear transformations, eigenvalues and eigenvectors, and inner product spaces. This class is required for students majoring in mathematics and many areas of science and engineering.

General Education Requirements: Math
Semesters Offered: Fall, Spring
Credit/Time Requirement: Credit: 3; Lecture: 3; Lab: 0
Clock/Hour Requirements: 0
Offered for Non-Credit: No
Prerequisites: MATH 1210

Justification:

This class is required for students majoring in mathematics, engineering, computer science, physics, and chemistry. The material from this course provides a foundation and problem-solving tools for students entering science-related fields. Linear Algebra is also recommended in some allied fields. Linear algebra concepts are common in advanced math and science contexts. This course is fully transferable to USU, U of U, BYU, Weber, SUU (3210).

Student Learning Outcomes:

Students will understand standard linear algebra concepts including matrices, inner products, vector spaces, and linear transformations. They will be able to think more abstractly.
Students will be able to solve problems relating to standard linear algebra concepts.

Students will believe that linear algebra, albeit abstract, is widely applicable in math and the sciences.

Content:

- Systems of Linear Equations and Matrices
    - Solving systems of equations by Guassian elimination
    - Matrices and matrix operations
    - Inverses and matrix arithmetic
    - Elementary matrices and finding inverses
    - Diagonal, triangular, and symmetric matrices

- Determinants
    - Evaluating determinants by row reduction
    - Properties of the determinant function
    - Cofactor expansion; Cramer's Rule

- Vectors in 2-Space and 3-Space
    - Geometric approach
    - Norm of a vector and vector arithmetic
    - Dot product; projections
    - Cross products
    - Lines and planes in 3-space

- Euclidean Vector Spaces
    - Euclidean n-space
    - Linear transformations from n-space to m-space

- General Real Vector Spaces
    - Properties of a vector space
    - Subspaces
    - Linear independence
    - Basis and dimension
    - Row space, column space, and nullspace
    - Rank and nullity

- Inner Product Spaces
    - Inner products
    - Angle and orthogonality
    - Orthonormal bases; Gram-Schmidt Process; QR decomposition
    - Best approximation; least-squares
    - Orthogonal matrices; change of basis

- Eigenvalues and Eigenvectors
    - Diagonalization
    - Orthogonal diagonalization

- Linear Transformations
    - Kernel and range
    - Inverse transformations
    - Matrices of linear transformations

6) Apply computational skills to a variety of contexts.
Students solve 10-20 homework problems per section; most of which require computation. They receive scores and feedback on their assignments. Linear Algebra stretches students minds in different ways than regular algebra or calculus; there are some quite abstract concepts, so the computations are not all numerical. Students also learn to use standard software packages in linear algebra such as Maple or MATLAB.

Key Performance Indicators:

Homework: 10%-25% of the final grade
Quizzes: 15%-30% of the final grade

Tests: 15%-25% of the final grade

Comprehensive final exam: 15%-30% of the final grade

Representative Text and/or Supplies:
Anton, Howard, *Elementary Linear Algebra*, current edition, John Wiley & Sons, Inc.

Optimum Class Size: 24
Maximum Class Size: 30

Signatures:

I hereby submit this course syllabus:

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Kari Arnoldsen, PhD, Professor

I hereby find this course consistent with the goals and resources of the Mathematics Department:

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Kari Arnoldsen, PhD, Professor, Chair

I hereby find this course consistent with the goals and resources of the Natural Science and Mathematics Division:

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Dan Black, EdD, Associate Professor, Dean

I have discussed the need for library resources related to this class with the person submitting the syllabus:

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Lynn Anderson, MLIS, Technical Services Librarian (Main Campus)

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Michelle Olsen, MLS, Campus Librarian (Richfield Campus)